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Jennifer D. Adamson
Date: June 16, 2005

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS AND INTERFERENCES

In re application of David Cleve Eubanks et al.)
Serial No.: 10/648,072) Group Art Unit: 1764
Filed: August 26, 2003) Examiner: Thuan D. Dang
For: Preparation Method)
Confirmation No. 3376)

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Dear Sir:

APPEAL BRIEF UNDER 37 C.F.R. §1.192

The following brief is on appeal of a final rejection of Claims 1-6 of the above-identified U.S. patent application. The final rejection was contained in an Office Action mailed on January 21, 2005, and a Notice of Appeal was timely mailed by Applicant on April 21, 2005. This brief is filed in triplicate. Please charge the \$500.00 fee for filing of this brief to Shell Oil Company Deposit Account No. 19-1800. It is respectfully requested that the Board consider the following arguments and reverse the final rejection of Claims 1-6 in the above-identified application.

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REAL PARTY IN INTEREST

The real party in interest is Shell Oil Company.

RELATED APPEALS AND INTERFERENCES

There are no other known appeals or interferences that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

All of the claims in this application (i.e., Claims 1-6, as amended November 2, 2004) are on appeal.

STATUS OF AMENDMENTS

There has been no amendment filed subsequent to the Final Office Action, mailed January 21, 2005. All earlier amendments have been entered. A copy of the claims, as amended on November 2, 2004, are reported in Appendix 1 to this Appeal Brief.

SUMMARY OF INVENTION

The present invention provides a process for preparing styrene or substituted styrene compounds from a mixture comprising alkylbenzene hydroperoxide (or substituted alkylbenzene hydroperoxides) and an alkene. The novel process comprises two sequential process steps, which are set forth as steps (a) and (b) in the claims. Step (a) is an epoxidation step and step (b) is a dehydration step. For convenience, subsequent references in this Appeal Brief to "alkylbenzene hydroperoxide", "styrene" or "phenyl alkanol" will be understood to include substituted such compounds as well.

In step (a), an alkylbenzene hydroperoxide is converted to a phenylalkanol by reaction with an alkene. The alkene reactant is converted to the corresponding alkylene oxide that is removed from the reaction mixture along with unreacted alkene, leaving what is referred to in the specification and the claims as a "crude" phenylalkanol. The crude phenylalkanol contains a variety of high molecular weight compounds, which are referred to in the specification as "heavy components" and "heavy compounds." The reaction of ethylbenzene hydroperoxide with propylene (i.e., propene) is illustrative. In that reaction, the crude phenylalkanol contains acetophenone and a variety of heavy components in addition to the 1-

phenylethanol and 2-phenylethanol isomers. The crude phenylalkanol is then used in the present invention as a reactant in step (b).

In step (b), the phenylalkanol constituent of the crude phenylalkanol is dehydrated to form the corresponding styrene or substituted styrene product.

One of the advantages of the present invention is that the crude phenylalkanol from step (a) can be used as is in step (b) without having to go through one or more purification steps (e.g., fractional distillation) to separate and purify the phenylalkanols before dehydration. By avoiding such separation and purification steps, decreased amounts of a heavy residue, relative to the amount of styrenic product, are produced in the dehydration reaction. This is shown by the examples in the specification. Compare the results of Examples 1 and 3 with the results of Examples 2 and 4, respectively.

The present invention has substantial procedural and economic advantages that flow from the ability to use the “crude” phenylalkanol produced in step (a), as is, in step (b).

ISSUES

1. Whether the Final Rejection of Claims 1-6 under 35 U.S.C. §103(a) for allegedly being obvious over Dubner et al. (USP 5,210,354) in view of Joustra et al. (EP 0 345 856) is in error.
2. Whether the Final Rejection of Claims 1-6 under 35 U.S.C. §103(a) for allegedly being obvious over Joustra et al. (EP 0 345 856) in view of Dubner et al. (USP 5,210,354) is in error.

GROUPING OF CLAIMS

The claims on appeal herein stand or fall together.

ARGUMENT

The bases of rejection under 35 U.S.C. §103 are erroneous in several ways.

ERROR 1: Examiner has misinterpreted the claims. Examiner concluded on page 4 of the Final Rejection that Applicants have not excluded any purification step (of the phenylalkanol reactant used in step (b)) of Claims 1-6. That is error. Step (a) of Claim 1 states that the reaction produces a mixture comprising a “crude phenyl alkanol.” Step (b) of Claim 1 states that the “crude phenyl alkanol” is dehydrated. The term used in step (a) is the same as used in step (b). That means steps (a) and (b) are conducted sequentially and without

an intervening phenylalkanol purification step, such as that required by Dubner et al. See, for example, the teachings in Dubner et al. at Col. 3, lines 27-39, and Col. 4, lines 40-57. The term “crude phenyl alkanol” in the claims is defined by the disclosure in the Specification at page 4, lines 9-28, and by reference to the disclosure in the Examples (e.g., see the disclosure at page 5, lines 4-8, and the table of data on page 5 of the Specification). Appellants’ attorney discussed the term as it was used in the claims, as amended, in her response filed on November 2, 2004. See page 4 of the Response, the fourth full paragraph.

ERROR 2: Examiner failed to consider the claimed subject matter as a whole, as required under 35 U.S.C. §103. Crude phenylalkanols from step (a) are used in step (b), not purified materials as required by the reference (Dubner et al.). Steps (a) and (b) in the present invention are conducted sequentially without any intervening separation and purification step(s), Examiner’s allegation to the contrary notwithstanding. Examiner’s argument on page 4 of the Final Rejection that Applicants have not excluded any purification step ignores the clear recitation in step (b) of crude phenylalkanol being used as the reactant. The ability to use crude phenylalkanol in the dehydration reaction is of major importance to the present invention. One of the advantages of the present invention is that the crude phenylalkanol from step (a) can be used as is in step (b) without having to go through one or more purification steps (e.g., fractional distillation) to separate and purify the phenylalkanols before dehydration. Such separation and purification step(s) are time consuming and costly. In addition, avoiding such separation and purification steps produces decreased amounts of heavy residue, relative to the amount of styrenic product produced in the dehydration reaction. This is shown by the examples in the specification. Compare the results of Examples 1 and 3, respectively, in which the crude phenylalkanol was used, as is, in the dehydration step with the results of comparative Examples 2 and 4, in which the phenylalkanol was subjected to purification by distillation, as in the Dubner et al. reference.

ERROR 3: Examiner has not established a *prima facie* case of obviousness for either basis of Final Rejection under 35 U.S.C. §103(a).

A. Requirements for a *Prima facie* Case of Obviousness

Examiner’s failure to establish a *prima facie* case of obviousness is a fundamental error.

In rejecting claims under 35 U.S.C. §103, the examiner bears the initial burden

of presenting a *prima facie* case of obviousness . . . 'A *prima facie* case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art . . .'" *In re Rijckaert*, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993).

Specifically, to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. See *In re Royka*, 180 USPQ 580 (CCPA 1974). In addition, in order to establish a *prima facie* case of obviousness, the Examiner must show some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. See, e.g., *In re Fine*, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). Furthermore, in leading one skilled in the art, the prior art must suggest to the ordinary skilled artisan that the combination should be carried out and would have a reasonable likelihood of success, viewed in the light of the prior art. *In re Dow Chemical Co*, 5 U.S.P.Q. 2d 1529, 1532 (Fed. Cir. 1988)(emphasis added). Indeed, both the suggestion and the expectation of success must be found in the prior art, not in the Appellant's disclosure. Id. Additionally, the Federal Circuit has stated that a reference should be considered in its entirety, with due consideration given to disclosures that diverge or teach away from the invention as well as disclosures which direct one skilled in the art to the invention. *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 227 U.S.P.Q. 657, 669 (Fed. Cir. 1985). Combinations of prior art made in hindsight are not permitted.

B. The Final Rejection

The Examiner issued a Final Rejection of Claims 1-6 under 35 U.S.C. § 103(a) as being unpatentable over (1) Dubner et al. in view of Joustra et al., and (2) Joustra in view of Dubner et al. Examiner's reasoning in support of the rejections is found on pages 3 and 4 of the Final Rejection.

C. Examiner's Reasoning Is Incorrect

It is respectfully submitted that Examiner's explanation of each rejection is nothing more than an attempt to recreate Applicants' invention using impermissible hindsight. Dubner et al. and Joustra et al. both teach, generically, the epoxidation step and a dehydration step. In doing so, they confirm Appellants' teaching in the Specification that such reactions

were broadly known. The “scope and content” of Dubner et al. and Joustra et al., however, is much different than portrayed by Examiner.

Dubner et al. is a complex, multi-step procedure that attempts to optimize the production of product from what they call the “Propylene Oxide-Styrene Monomer Process” by their treatment of a particular heavy residue stream. Dubner et al. require purification of the phenylalkanol reactant before the dehydration step to produce styrene. This purification is done by distillation, during which Dubner et al. attempt to remove the heavy components from the phenylalkanol reactant. See, for example, the teachings at column 3, lines 27-39, and column 4, lines 40-57. In contrast, Appellants use a “crude phenylalkanol” in the dehydration step. Examiner has not established a *prima facie* case as to why it would have been obvious to delete the required purification/distillation step in Dubner et al. and use crude phenylalkanol in the dehydration step.

Accordingly, the combination of Dubner et al. in view of Joustra et al. fails as a basis of rejection under 35 U.S.C. §103(a).

Similarly, the basis of rejection over Joustra et al. in view of Dubner et al. is without merit. The thrust of the disclosure of Joustra et al. is a new process for preparing oxirane compounds, and new heterogeneous catalysts that can be used in that process. Joustra et al. does not disclose the dehydration process (except generically on page 3, line 30 et seq.), and does not provide any processing details with respect to the phenylalkanols used in the dehydration process (e.g., purification/distillation). Examiner’s reliance on Dubner et al. to fill in the gaps is again merely a hindsight attempt at piecemeal reconstruction of the presently claimed invention, and it fails for the same reasons as noted above. Even if there was some reason, other than Appellants’ own teaching, to use the conditions set forth in Dubner et al. for the dehydration step, one is still left with the need to purify the phenylalkanol reactant by distillation before use in the dehydration step. That requirement is not part of Appellants’ claimed process. The basis of rejection is wrong and should be reversed.

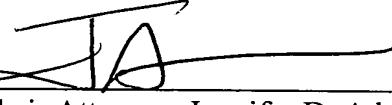
CONCLUSION

The present invention has substantial procedural and economic advantages that flow from the ability to use the “crude phenylalkanol” produced in step (a) as is in step (b). The

bases of rejection of the Claims under 35 U.S.C. §103(a) are improper. The reversal of the Examiner is, therefore, respectfully requested.

Respectfully submitted,

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APPENDIX

1. A method of preparing styrene or substituted styrene comprising:
 - (a) converting a mixture comprising alkylbenzene hydroperoxide or substituted alkylbenzene hydroperoxide and an alkene to a mixture comprising a crude phenyl alkanol or substituted phenyl alkanol and an alkylene oxide in the presence of a heterogeneous catalyst; and
 - (b) dehydrating the crude phenyl alkanol or substituted phenyl alkanol or substituted phenyl alkanol in the presence of a homogeneous dehydration catalyst to obtain styrene or substituted styrene.
2. The method of claim 1, which is preceded by a non-catalyzed step wherein alkylbenzene or substituted alkylbenzene is oxidized to a mixture comprising alkylbenzene hydroperoxide or substituted alkylbenzene hydroperoxide.
3. The method of claim 1 in which the alkylbenzene hydroperoxide comprises ethylbenzene hydroperoxide and the phenyl alkanol comprises 1-phenylethanol.
4. The method of claim 3 in which the heterogeneous catalyst is selected from the group consisting of supported titanium compounds, zirconium compounds, molybdenum compounds, vanadium compounds, and the homogeneous catalyst is selected from the group consisting of inorganic acids and organic compounds.
5. The method of claim 1 in which the heterogeneous catalyst comprises titanium on silica, and the homogeneous catalyst comprises an aromatic and/or sulfonic acid.
6. The method of claim 5, in which the homogeneous catalyst comprises p-toluene sulfonic acid.